

REMARKS

The Office Action of January 11, 2010, has been received and reviewed. Claims 1, 2, 4, 5, 11, 12, 14-17, 25-28, and 33-38 are currently pending in the application. Claims 1, 2, 4, 5, 11, 12, 14-17, 25-28, 33, and 38 stand rejected.

Support for the amendments to claims 1, 11, 14, 25, and 33 is found throughout the as-filed specification at least at paragraph [0021] and in FIG. 5 and 6. Claims 25-28 and 33-36 replace the term “layer” with the term “material.”

Applicant has amended claims 1, 4, 11, 14, 25-28, and 33-36, and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,712,185 to Tsai et al. in View of U.S. Patent No. 4,835,584 to Lancaster

Claims 1, 2, 4, 11, 12, 14, 16, 25-27, 33-35, and 37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,712,185 to Tsai et al. (hereinafter “Tsai”) in view of U.S. Patent No. 4,835,584 to Lancaster (hereinafter “Lancaster”). Applicant respectfully traverses this rejection, as hereinafter set forth.

To establish a *prima facie* case of obviousness the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974); *see also* MPEP § 2143.03. Additionally, the Examiner must determine whether there is “an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741, 167 L.Ed.2d 705, 75 USLW 4289, 82 U.S.P.Q.2d 1385 (2007). Further, rejections on obviousness grounds “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id.* at 1741, quoting *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006). Finally, to establish a *prima facie* case of obviousness there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Furthermore, the reason that would have prompted the combination and the reasonable expectation of success must be found in the prior art, common

knowledge, or the nature of the problem itself, and not based on the Applicants disclosure.

DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co., 464 F.3d 1356, 1367 (Fed. Cir. 2006); MPEP § 2144. Underlying the obvious determination is the fact that statutorily prohibited hindsight cannot be used. *KSR*, 127 S.Ct. at 1742; *DyStar*, 464 F.3d at 1367.

A *prima facie* case of obviousness under 35 U.S.C. § 103(a) cannot be established against any of claims 1, 2, 4, 11, 12, 14, 16, 25-27, 33-35, and 37 because the applied references themselves, or the inferences and creative steps that a person of ordinary skill in the art would have employed at the time of the invention, would not have taught or suggested the claim limitations.

Tsai teaches a process for fabrication of isolation structures. The process of Tsai includes forming a trench 38 through a photomask 37, a sacrificial silicon oxide layer 36, a silicon nitride layer 34, and a pad oxide layer 32, and into a silicon substrate 30. *Tsai*, col. 2, line 53, to col. 3, line 18; FIG. 3C and 3D. Once the trench 38 is formed, the photomask 37 is removed and the edges of the remainder of the silicon nitride layer 34A are etched back. *Id.*, col. 3, lines 9 and 19-33; FIG. 3E. Thereafter, exposed silicon at the surfaces of the trench 38A is oxidized to form side wall oxidation 39. *Id.*, FIG. 3F; col. 3, lines 34-38. The side wall oxidation 39 relieves defects that are formed in the silicon substrate 30 as the edges of the silicon nitride layer 34A are etched back. *Id.*, col. 3, lines 34-37.

Lancaster teaches a process for forming a transistor within a trench. *Lancaster* at the Abstract. The process includes forming an oxide lining 52a within trenches 56 that extend into a silicon substrate 50. *Id.*, FIG. 5D; col. 3, lines 43-45. The oxide lining 52a is purportedly formed to protect the silicon substrate 50 as a silicon nitride mask layer 53 is subsequently removed. *Id.*, col. 3, lines 39-49; FIG. 5E. Notably, the *entire* silicon nitride mask layer 53 is removed. *Id.* The oxide lining 52a, which is included merely for the sake of providing etch selectivity to prevent enlargement of the trenches 56 during removal of the silicon nitride mask layer 53, is removed following removal of the silicon nitride mask layer 53. *Id.*, col. 3, lines 46-49 and 54-58.

Claims 1, 2, and 4

It is respectfully submitted that Tsai and Lancaster do not teach or suggest all the limitations of amended independent claim 1 because Tsai and Lancaster, alone or in combination, do not teach or suggest the limitation of “removing a portion of the buffer material to reduce a thickness of the buffer material and laterally recess a side wall defined by the buffer material relative to a side wall defined by the dielectric material and relative to a side wall of the at least one trench.” Tsai teaches undercutting or descumming a silicon nitride mask layer 34 to laterally remove a portion thereof. As shown in FIGS. 3D and 3E of Tsai, an upper surface of the silicon nitride layer 34 is covered by the sacrificial layer 36 while the silicon nitride layer 34 is undercut. Therefore, a thickness of the silicon nitride layer 34 is not reduced. The Examiner asserts that “[d]uring the process of removing [the silicon nitride layer] 34 the thickness is reduced.” *Office Action*, page 3. Although Tsai does teach completely removing the silicon nitride layer 34B after forming the isolation region 40, Tsai does not teach or suggest reducing a thickness of the silicon nitride layer 34 and laterally recessing a side wall defined by the silicon nitride layer 34B. Accordingly, Tsai does not teach or suggest the above-mentioned limitation of claim 1.

The Examiner relies on Lancaster as teaching forming a sacrificial oxide 52a on trench surfaces prior to protect the surfaces during removal of a nitride trench etch mask with phosphoric acid. *Id.* However, Lancaster also does not teach or suggest removing a portion of a buffer material to reduce a thickness of the buffer material and laterally recess a side wall defined by the buffer material relative to a side wall defined by the dielectric material and relative to a side wall of the at least one trench. Instead, Lancaster teaches removing an entire silicon nitride mask layer 53 overlying an oxide lining 52a on a silicon substrate 50.

Because the combination of Tsai and Lancaster, and the inferences and creative steps that a person of ordinary skill in the art would have employed at the time of the invention, would not have taught or suggested all of the limitations of amended independent claim 1, it is respectfully submitted that a *prima facie* case of obviousness has not been established against claim 1.

Claims 2 and 4 are each allowable, *inter alia*, as depending from allowable claim 1.

Claims 11, 12, 14, and 16

It is respectfully submitted that Tsai and Lancaster do not teach or suggest all the limitations of amended independent claim 11 because Tsai and Lancaster, alone or in combination, do not teach or suggest the limitation of “laterally recessing at least one side wall of the buffer material to expose portions of an upper surface of the dielectric material adjacent to an upper edge of the at least one trench while an upper surface of the buffer material is exposed,” as recited in claim 11. Although Tsai teaches undercutting the silicon nitride layer 34B to laterally remove a portion thereof, Tsai does not teach or suggest laterally recessing the silicon nitride layer 34B while an upper surface of the silicon nitride layer 34B is exposed. Rather, as shown in FIGS. 3D and 3E, the silicon nitride mask layer 34B is covered by the sacrificial layer 36 during the undercutting process such that the upper surface of the silicon nitride layer 34B is not exposed. Tsai further teaches removing the silicon nitride layer 34B after forming the isolation region 40A. However, removal of the silicon nitride layer 34B of Tsai does not include removing material from an upper surface and side walls of the buffer material to laterally recess at least one side wall of the buffer material.

Lancaster does not cure the deficiencies of Tsai because Lancaster also fails to teach or suggest removing material from an upper surface and side walls of the buffer material to laterally recess at least one side wall of the buffer material. Instead, Lancaster teaches removing an entire silicon nitride mask layer 53 overlying an oxide lining 52a on a silicon substrate 50.

Since neither Tsai nor Lancaster, alone or on combination, teaches or suggests all of the limitations of independent claim 11, as amended herein, Applicant respectfully submits that this claim recites subject matter allowable over Tsai and Lancaster.

Each of claims 12, 14, and 16 is allowable, *inter alia*, as depending from allowable claim 11.

Claim 14 is further allowable since neither Tsai nor Lancaster, alone or in combination, teach or suggest the limitation of “removing material from an upper surface and side walls of the buffer material to laterally recess the at least one side wall while reducing a thickness of the buffer material.” As shown in FIGS. 3D and 3E, Tsai teaches undercutting the silicon nitride mask layer 34B while it is covered by the sacrificial layer 36. Thus, the silicon nitride layer 34 is

not recessed while a thickness of the silicon nitride layer 34 is reduced. Lancaster teaches removing an entire silicon nitride mask layer 53 overlying an oxide lining 52a on a silicon substrate 50 and, thus, does not cure the deficiencies of Tsai.

Claims 25-27

It is respectfully submitted that Tsai and Lancaster do not teach or suggest all the limitations of amended independent claim 25 because Tsai and Lancaster, alone or in combination, do not teach or suggest the limitation of “removing a portion of the buffer film material from at least an upper surface thereof, a remaining portion of the buffer layer having a reduced a thickness,” as recited in claim 25. Rather, Tsai teaches removing the entire silicon nitride layer 34B after forming the isolation region 40A. The Examiner asserts that “[d]uring the process of removing [the silicon nitride layer] 34 the thickness is reduced.” *Office Action*, page 3. Since Tsai teaches removing the silicon nitride layer 34B, Tsai does not teach or suggest a removing material from an upper surface of the silicon nitride layer 34B such that a remaining portion of the buffer layer has a reduced thickness.

The Examiner relies on Lancaster as teaching forming a sacrificial oxide 52a on trench surfaces prior to protect the surfaces during removal of a nitride trench etch mask with phosphoric acid. *Id.* However, Lancaster also does not teach or suggest removing a portion of the buffer film material from at least an upper surface thereof, a remaining portion of the buffer layer having a reduced a thickness. Instead, Lancaster teaches removing an entire silicon nitride mask layer 53 overlying an oxide lining 52a on a silicon substrate 50.

Since neither Tsai nor Lancaster, alone or on combination, teaches or suggests all of the limitations of independent claim 25, as amended herein, Applicant respectfully submits that this claim recites subject matter allowable over Tsai and Lancaster.

Each of claims 26 and 27 is allowable, *inter alia*, as depending from allowable claim 25.

Claims 33-35, and 37

It is respectfully submitted that Tsai and Lancaster do not teach or suggest all the limitations of amended claim 33 because Tsai and Lancaster, alone or in combination, do not teach or suggest the limitation of “removing material from an upper surface and side walls of the buffer film material to form a structure comprising the buffer film material and having a side wall laterally recessed with respect to at least one side wall of the trench,” as recited in claim 33. Rather, Tsai teaches undercutting a silicon nitride layer 34 before forming an isolation region 40. As shown in FIG. 3D and 3E of Tsai, material is not removed from an upper surface and side walls of the silicon nitride layer 34 during undercutting. Although Tsai teaches removing the entire silicon nitride layer 34 after forming the isolation region 40, a structure having a side wall laterally recessed with respect to at least one side wall of the trench is not formed during this process.

The Examiner relies on Lancaster as teaching forming a sacrificial oxide 52a on trench surfaces prior to protect the surfaces during removal of a nitride trench etch mask with phosphoric acid. *Id.* However, Lancaster teaches removing an entire silicon nitride mask layer 53 overlying an oxide lining 52a on a silicon substrate 50 and, thus, does not cure the deficiencies of Tsai.

Because the combination of Tsai and Lancaster, and the inferences and creative steps that a person of ordinary skill in the art would have employed at the time of the invention, would not have taught or suggested all of the limitations of amended independent claim 33, it is respectfully submitted that a *prima facie* case of obviousness has not been established against claim 33.

Claims 34, 35, and 37 are each allowable, *inter alia*, as depending from allowable claim 33.

It is, therefore, respectfully requested that the 35 U.S.C. § 103(a) obviousness rejections of claims 1, 2, 4, 11, 12, 14, 16, 25-27, 33-35, and 37 be withdrawn, and that each of these claims be allowed.

Obviousness Rejection Based on Tsai in View of Lancaster and Further in View of the Examiner's Comment

Claims 17 and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of Lancaster as applied to claims 1, 2, 4, 11, 12, 14, 16, 25-27, 33-35 and 37 above, and further in view of the Examiner's comment. Applicants respectfully traverse this rejection, as hereinafter set forth.

The Examiner relies on Tsai as teaching removal of 50-100 Angstroms of the silicon nitride layer 34 and, in addition, asserts that claims 17 and 38 are obvious as a matter of design choice. *Office Action*, page 4. However, claims 17 and 38 respectively depend from claims 11 and 33 and, thus, include all of the limitations of claims 11 and 33. Accordingly, claim 17 includes the limitation of "laterally recessing at least one side wall of the buffer material to expose portions of an upper surface of the dielectric material adjacent to an upper edge of the at least one trench while an upper surface of the buffer material is exposed," as recited in claim 11. Claim 38, therefore, includes the limitation of "removing material from an upper surface and side walls of the buffer film material to form a structure comprising the buffer film material and having a side wall laterally recessed with respect to at least one side wall of the trench," as recited in claim 33. Tsai and Lancaster, alone or in combination, do not teach or suggest these limitations for the reasons previously discussed. Thus, claims 17 and 38 are each allowable as depending respectively from claims 11 and 33.

It is, therefore, respectfully requested that the 35 U.S.C. § 103(a) obviousness rejections of claims 17 and 38 be withdrawn, and that each of these claims be allowed.

Obviousness Rejection Based on Tsai in View of Lancaster and Further in View of "An Optimized Densification of the Filled Oxide Quarter Micron Shallow Trench Isolation (STI)" to Lee et al.

Claims 5, 15, 28, and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of Lancaster and further in view of "An Optimized Densification of the Filled Oxide Quarter Micron Shallow Trench Isolation (STI)" to Lee et al. (hereinafter "Lee"). Applicants respectfully traverse this rejection, as hereinafter set forth.

Each of claims 5, 15, 28, and 36 is allowable, *inter alia*, as depending from an allowable base claim.

Thus, it is respectfully requested that the 35 U.S.C. § 103(a) rejections of claims 5, 15, 28, and 36 be withdrawn, and that each of these claims be allowed.

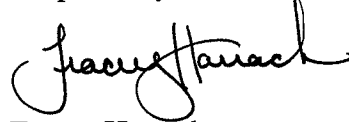
ENTRY OF AMENDMENTS

The amendments to claims 1, 4, 11, 14, 25-28, and 33-36 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 1, 2, 4, 5, 11, 12, 14-17, 25-28, and 33-38 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Tracey Harrach', written in a cursive style.

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